

A STUDY ON CORRELATION OF PAIN ON COGNITIVE FUNCTION IN PATIENTS WITH CHRONIC LOW BACK PAIN

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ABSTRACT

BACKGROUND AND OBJECTIVE

The purpose of this study is to find out the correlation of pain, on cognitive function of the patients with low back pain. Finding the correlation of pain on cognitive function will help us, to find out the cognitive lag in low back pain patients (Serena Gordon et al-2006)²⁰.

METHODS

30 low back pain patients are screened, according to the inclusion criteria and by Oswestry low back pain disability questionnaire, the scorings are done according to the scale. Patients are treated by conventional physiotherapy treatment, according to the cause; the pain level is measured by Oswestry back pain disability questionnaire, after each treatment. The Mini Mental State Examination is repeated, when the pain decreased below Moderate intensity, after the treatment and the scores are recorded. In Oswestry back pain questionnaire, the scoring is done for each of the ten sections. For each section, the subject is asked to choose the statement that best describes their status.

DISCUSSION

In this study it is proved that, decrease of chronic pain will improve MMSE score that is the cognitive status, of the low back pain patient. Though, decrease in pain from moderate intensity to mild (pain intensity), it improves the cognitive status of patients and the individual score in MMSE of chronic low back pain patients shows that, there is some lag still present in memory, attention and problem solving abilities.

RESULTS

Table 1 shows that, there is a significant negative continuous correlation between MMSE score and pain score ($r=0.063$ $p=0.740$). Table 2 shows that, there is a non-significant low degree of positive correlation between MMSE score I and pain score I ($r=0.113$ $p=0.153$). Table 3 shows that, there is a significant difference between MMSE score and pain score, before and after treatment. ($P<0.05$), thus it states that, there is an increase in cognitive function after treatment, when comparing cognitive function before and after conservative physiotherapy treatment.

CONCLUSION

This study concludes that, there is a correlation between pain and cognitive function in patients, with chronic low back pain.

KEYWORDS: Chronic Low Back Pain, Pain & Cognitive Function

INTRODUCTION

Low back pain is the most common problem, that affects nearly all age groups, irrespective of their work which requires a physically demanding or a sedentary one (Hartvigsen J. et al - 2006) ⁵. As low back is one of the commonest areas where there is a constant need of good posture and strength to meet the work demand, it is the high risk area of getting pain (Arthur White) ¹.

Patients with chronic pain present with multiple complaints and problems, and proved a unique challenge to the physical therapist. Because physical therapists often treat patients emerging from an acute pain stage into a chronic pain state, they must be able to recognize this changing state and plan treatment accordingly. Although patients with acute pain respond well to various therapeutic modalities, patients with chronic pain present with a complex of psychological, sociological and emotional states that affect the manner in which they experience must be addressed, and a multidisciplinary treatment program must be considered. Restoration of function, not pain relief, is the primary physical therapy outcome with this patient population, and physical therapist plays a primary role in the rehabilitation process (Susan O Sullivan, et al -2001) ² ¹

Pain is an unpleasant and unwanted sensation; the perception level of pain will differ from person to person affecting the mental status of the patients. Acute pain is the one, which, provoked by noxious stimulation produced by injury or disease with unpleasant sensory and emotional experience. Chronic pain is the one that persist beyond the usual course of healing of an acute disease or beyond the time for an injury to heal (Meier, M, et al-1987)¹⁷

In a new doctoral dissertation on Back pain and neck pain hampers memory, the participants were divided into neuropathic exhibiting pain because of sciatic nerve damage and non-neuropathic. Brain scans showing gray matter volume were compared. (Stefan et al- 2005)¹⁹

In earlier research, Apkarian and colleagues found that back pain sustained for six months or longer is accomplished by abnormal brain chemistry, indicating chemical changes in the area of the brain known to be important in making emotional assessments, including decision-making and for controlling social behavior. People in pain actually do have these problems with their so called cognitive function. It was found that pain in the back and neck leads to impaired memory and powers of concentration and also found that such pain hastens mental aging. This study also found that normal loss of memory capacity that comes with aging is also more palpable among people in pain. Based on these results, he embarked on the brain atrophy study.

It is possible that some of the observed, decreased gray matter shown in this study reflects tissue shrinkage without substantial neuronal loss, suggesting that proper treatment would reverse those portions of the decreased brain gray matter. The atrophy also may be attributable to more irreversible processes, such as neuro degeneration. Other research has shown that spinal cord neurons undergo apoptosis, cell death in rats with neuropathic pain. Chronic pain is a state of continuous persistent perception with associated negative affect and stress, one mechanistic excitotoxic and inflammatory mechanisms.

The researchers hypothesize that atrophy of brain circuitry involved in pain perception may dictate the properties of the pain state, such that as a trophy of elements of the circuitry progresses, the pain condition becomes more irreversible and less responsive to therapy. (Apkarian - 2006)²⁴

In an article published in Indian Physiol Pharmacol, about contingent negative variation response in chronic pain patients. The contingent negative variation response was measured from CZ x FZ in controls and chronic pain patients suffering from cervical spondylosis and low back ache, due to sciatica with duration of pain 5 to 10 years and intensity varied from moderate to severe as adjusted by visual Analogue scale. The result shows that there was a significant increase in P3 latency, RT-reaction time with chronic pain patients, indicating that there is a blunting of cognitive functions and increase in reaction time in patients suffering from chronic pain. These patients also took more time to orient to contingent negative variation response paradigm. (Tandon op, et al; 1996)²³

The Mini Mental State Examination is a tool that can be used to systematically and thoroughly assess mental status. It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. The maximum score is 30. A score of 23 or lower is indicative of cognitive impairment. The Mini Mental State Examination takes only 5-10 minutes to administer and is therefore practical to use repeatedly and routinely. (Folstein-2004)¹³

The Oswestry low back pain questionnaire is a tool, that can be used to systematically and thoroughly assess the pain disability. It is a 10 section questionnaire with 6 questions in each section that test pain intensity, personal care, sleeping, lifting, walking, sitting, social life, traveling, changing degree of pain. The maximum score is 50 usually calculated in percentage as 100%. A score of 40%-60% comes under moderate pain disability. (Fairbank.J.C-2001)"

The purpose of this study is to find out the correlation of pain on cognitive function of the patients with low back pain. Finding the correlation of pain on cognitive function will help us to find out the cognitive lag in low back pain patients (Serena Gordon et al-2006)²⁰

Need and Significance

The fact that pain also hampers basic mental faculties makes it all the more urgent to come to grips with this public health problem as the maximum score of the mini-mental state examination is 30, out of this 24-30 is considered as normal¹⁹. As like Soderfjell addressed the need of this study is to find out how much the cognitive function of patients is impaired with pain and that should be addressed by doctors, physical therapist, occupational therapist and the like so that instructions, information and training programme are made clear and easy, for patients to understand,. If there is a cognitive lag in patients with low back pain, cognitive therapy can be given to enhance the cognitive lag in patients with low back pain. (Gold Stein, et al- 2005)}

MATERIALS AND METHODOLOGY

Research Design

Observational study

Study Setting

Meenakshi General Hospital (maduravoyal) Meenakshi medical college and hospital (Enathur)

Outpatient department Meenakshi College of physiotherapy (virugambakkam)

Sampling Size

30 chronic low back pain patients

Sampling Criteria

30 chronic low back pain samples are selected after general screening and by Oswestry basic pain questionnaire.

Inclusion Criteria

- Patients with age 30-60 (both male and female)
- Mechanical back pain
- Chronic low back pain with sciatica
- Normal upper limb function to do Mini Mental State Examination test.
- Patients those who can able to follow the therapist command.
- Patients with moderate pain, disability according to Oswestry low back pain disability questionnaire

Exclusion Criteria

- Patients with known mental illness
- Acute vertebral fracture
- Disease of the spinal cord and vertebral fracture
- Other systemic illness which cause a referred pain over the back such as gastritis, renal problems, etc.,

Tools

- Examination couch
- Questionnaire
- Pencil

Materials

- MINI MENTAL STATE EXAMINATION
- OSWESTRY BACK PAIN QUESTIONNAIRE

Data Collection Method

A detailed assessment of low back pain patients is done as per physiotherapy gnomes, with the guidance of; orthopedic surgeon and Neuro surgeon and the patients are selected for this study according to the inclusion criteria. Further the patients are screened by Oswestry low back pain disability questionnaire and the patients with moderate pain, disability index with a score of 40% - 60%, only include 30 low back pain patients are screened according to the inclusion criteria and by Oswestry low back pain disability questionnaire, the scorings are done according to the scale. Those patients with modulating pain, disability are included in this study

Mini Mental State Examination is performed for these patients before conservative physiotherapy treatment and the scores are recorded. This is a double blind study in order to avoid rater and bias

Patients are treated by conventional physiotherapy treatment, according to the cause; the pain level is measured (at the end of the 7th day of the treatment), by Oswestry back pain disability questionnaire after each treatment. The Mini Mental State Examination is repeated when the pain decreased below Moderate intensity after the treatment (that is once the patient pain intensity is mild (0% - 20%), according to Oswestry low back pain questionnaire) and the scores are recorded.

In Oswestry back pain questionnaire, the scoring is done for each of the ten sections. For each section, the subject is asked to choose the statement that best describes their status. The chosen statement receives scores: Statement A=0 B=1 C=2 D=3 E=4 F=5. Then add up all the points, divide that number by 50 and multiply by 100 to get percent disability.

During the minimal state examination, the scoring is done for all 11 questions, according to the performance of the patients for each question.

The scores of Oswestry low back pain disability questionnaire before and after the treatment are compared. The scores of MMSE before and after treatment are compared. The correlation between pain and cognitive function are found by comparing these scores. Thus, the data's for this study are collected by the above said procedure.

Table 1: Plan for Data Analysis

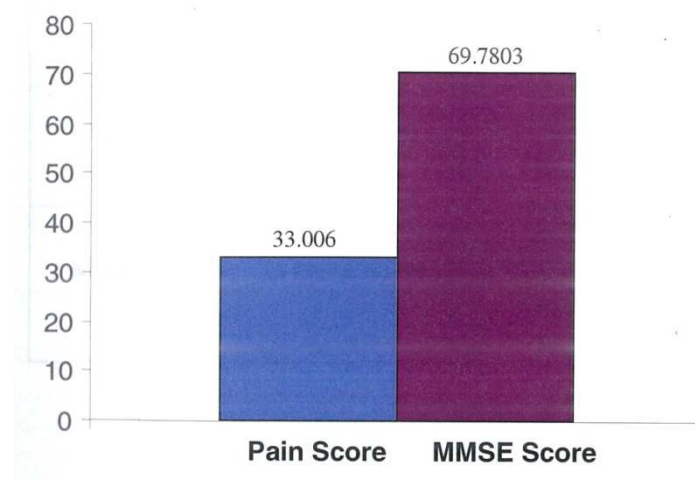
| Statistics | Methods | Description |
|-------------|---|---|
| Descriptive | Mean \pm S.D | To access the parameter of both groups |
| Inferential | Mann Whitney 'U' test Wilcoxon 'W' test | To compare the parameter between both groups. |

DATA ANALYSIS AND INTERPRETATION

The statistical analysis of the data collected is done by using Mean and Standard Deviation to assess the parameter of both groups, the inferential of the data collected is done by Man Whitney 'U' test, and Wilcoxon 'W' test.

Table 2: Chronic Low Back Pain and Cognitive Function before Treatment

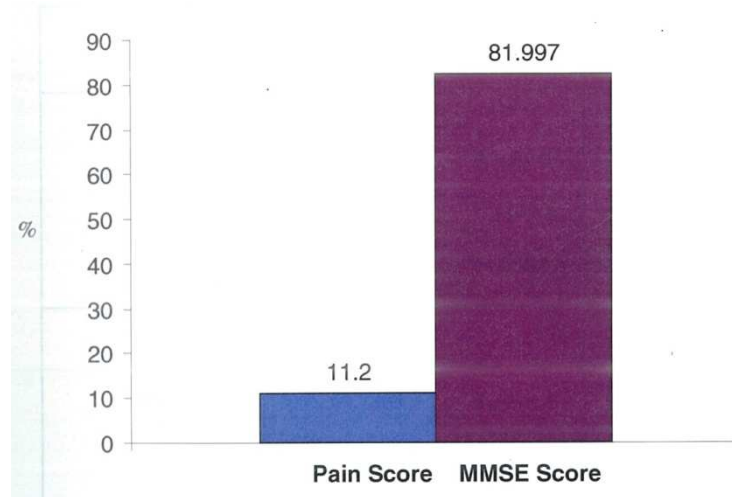
| Parameter | Mean \pm S.D | P value | Pearson correlation |
|------------|----------------------|---------|---------------------|
| Pain score | 33.006 \pm 3.66 | P=0.740 | -0.063 |
| MMSE Score | 69.7803 \pm 3.9086 | | |



Graph 1: Chronic Low Back Pain and Cognitive Function before Treatment

Table 3: Chronic Low Back Pain and Cognitive Function after Treatment

| Parameter | Mean \pm S.D | P value | Pearson correlation |
|------------|----------------------|---------|---------------------|
| Pain score | 11.200 \pm 4.0887 | P<0.05 | 0.113 |
| MMSE Score | 81.9977 \pm 5.5791 | | |

**Graph 2: Chronic Low Back Pain and Cognitive Function after Treatment****Table 4: Comparison of Chronic Low Back Pain and Cognitive Function Before and After Treatment**

| Parameter | Mean \pm S.D | | P. value |
|------------|----------------------|---------------------|----------|
| Pain score | Before treatment | After treatment | P<0.005 |
| | 33.006 \pm 3.66 | 11.200 \pm 4.0887 | |
| MMSE | 69.7803 \pm 3.9086 | 81.997 \pm 5.5791 | P<0.05 |

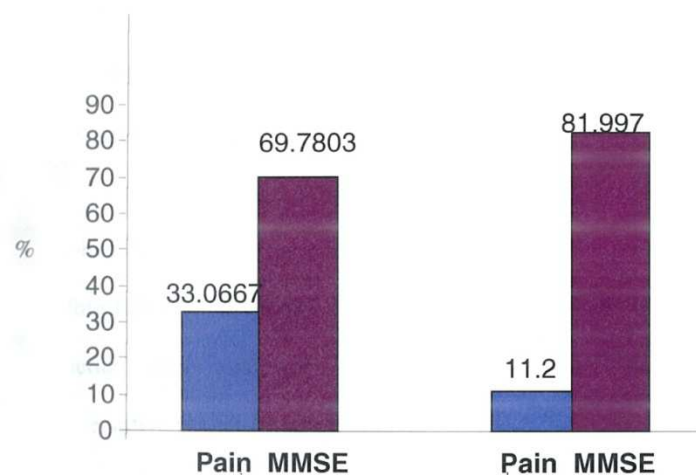
**Graph 3: Comparison of Chronic Low Back Pain and Cognitive Function Before and After Treatment Interpretation**

Table 1 show that there is a significant negative continuous correlation between MMSE score and pain score before treatment. ($R=0.063$ $p=0.740$), thus it states that when there is an increase in pain, there is a decrease in cognitive function, as cognitive function is a dependent variable, it is negatively correlated with chronic low back pain.

Table 2 shows that there is a non-significant low degree of positive correlation between MMSE score and pain score I ($r=0.113$ $p=0.153$), thus it states that there is an increase in cognitive function when there is a decrease in pain but this increase in cognitive function is not significant when compared with chronic low back pain.

Table 3 shows that there is a significant difference between MMSE score and pain score before and after treatment. ($P<0.05$), thus it states that there is an increase in cognitive function after treatment, when comparing cognitive function before and after conservative physiotherapy treatment

DISCUSSIONS

Loss in brain density is related to pain duration, indicating that 1.3 cubic centimeters of gray matter (the part of the brain that processes information and memory) are lost for every year of chronic pain.

Table 1 shows that there is a significant negative continuous correlation between MMSE score and pain score ($r=0.063$ $p=0.740$). Thus, by table 1 in this study it is proved that during moderate pain, disability the cognitive function is affected. It supports the study to examine brain changes in chronic pain conditions found that, about 6 percent of the American population is probably suffering from brain shrinkage from chronic back pain. On top of that there are people suffering from chronic stomach pain and other forms of chronic pain. So it is likely that more than 20 million Americans are suffering cognitive losses due to chronic pain. Although chronic pain greatly diminishes quality of life and increases anxiety and depression, it previously had been assumed that the brain reverts to its normal state after chronic pain stops.

In this study, they used structural magnetic resonance imaging brain scan data and two automated analysis techniques to contrast brain images from 26 participants with chronic back pain with those from matched normal subjects. All participants with chronic back pain had unrelenting pain for more than a year, primarily localized to the lumbosacral region, including the buttocks and thighs, with or without pain radiating to the leg. The participants were divided into neuropathic exhibiting pain because of sciatic nerve damage and non-neuropathies. Brain scans showing gray matter volume were compared found that back pain sustained for six months or longer is accompanied by abnormal brain chemistry, indicated by chemical changes in the area of the brain known to be important in making emotional assessments, including decision-making and for controlling social behavior.

According to inclusion certain in this study, the chronic low back pain, can affect the cognitive status of the patients of the physiological process caused due to the pain (production of prostaglandins, endorphin enkephalin chronic production of these chemicals affects the frontal lobe mainly, thus causing mental faculties to get affected)

Table 2 shows that there is a non-significant low degree of positive correlation between MMSE score I and pain score I ($r=0.113$ $p=0.153$). Thus, by table 2 in this study it is proved that the cognitive function is improved after treatment with minimal pain disability. The non significant low degree of positive correlation occurs due to the short duration of this study, this may be significant if the study duration is increased. This supports the study of Carvagee EJ et al; 2001 done on psychological and functional profiles in selected subjects, with low back pain states that psychometric testing scores improved when the Oswestry scores decreased.

Table 3 shows that there is a significant difference between MMSE score and pain score before treatment and after treatment, thus by table 3 in this study it is proved that when there is an increase in pain the MMSE score is decreased and if the pain is decreased there is an increase of MMSE score. This supports both the studies conducted by Vania

Apkarin and Carvagee that chronic pain affects mental faculties and it reverts to normal or near normal, when chronic pain is decreased any further cognitive lag due to chronic pain can be treated with cognitive therapy.

In this study it is proved that, decrease of chronic pain will improve MMSE score that is the cognitive status of the low back pain patient.

Though decrease in pain from moderate intensity to mild (pain intensity) improves the cognitive status of patients the individual score in MMSE of chronic low back pain patients shows that there is some lag still present in memory, attention and problem solving abilities.

LIMITATIONS

Further studies can be done on illiterate patients with chronic low back pain as only

Literate is included in this study.

Large sample can be used in future studies.

Study can be performed in a larger duration and follow up for years. Need further assessment for individual cognitive functions.

CONCLUSIONS

When there is an increase in pain, there is a decrease in cognitive function, as cognitive function is a dependent variable, it is negatively correlated with chronic low back pain and there is an increase in cognitive function when there is a decrease in pain but this increase in cognitive function is not significant when compared with chronic low back pain. There is an increase in cognitive function after treatment, when comparing cognitive function before conservative physiotherapy treatment, thus this study concludes that there is a correlation between pain and cognitive function in patients with chronic low back pain.

RECOMMENDATION

For further studies

- To find which particular cognitive function is affected more in chronic low back pain patients like memory, attention, and problem solving abilities, etc.
- To find the effective therapy to overcome this reduced cognitive function
- To find the other causes and their physiological process which affects the cognitive function in chronic low back pain patients.
- A study can be done in cognitive behavioral therapy along with conservative management for chronic low back pain patients.

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